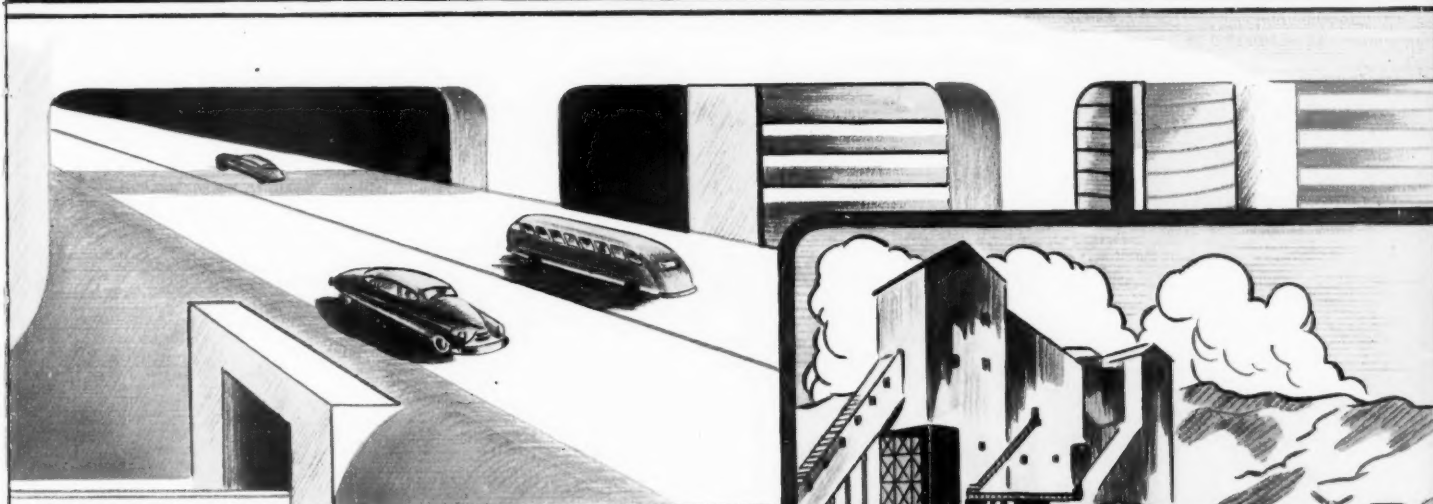


# *The* CRUSHED STONE JOURNAL



PUBLISHED QUARTERLY

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June 1952

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- The Trade Association Executive and the Federal Government
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# The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

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NATIONAL CRUSHED  
STONE ASSOCIATION



1415 Elliot Place, N. W.  
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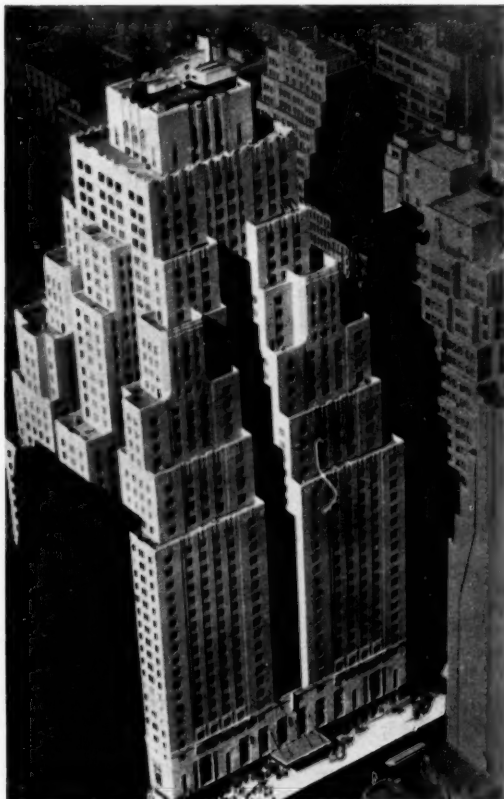
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# THE CRUSHED STONE JOURNAL

WASHINGTON, D. C.

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JUNE 1952

## Are Test Cylinders Indicative of the True Strength of Concrete in Structures?\*

By A. T. GOLDBECK

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National Crushed Stone Association  
Washington, D. C.

**T**HE design of a concrete structure is predicated on the assumption that the concrete will have sufficient strength for carrying the loads with an ample factor of safety. In certain parts of the structure exposed to the weather, durability also is important, but concrete compressive strength is an indirect measure of its durability. And so, compressive strength is an important measure of quality.

Flexural, or beam strength is most appropriate for use in concrete pavement design, for pavement slabs are beams subjected to high flexural stresses. However, compression tests frequently are made on pavement concrete to control its uniformity, and so compression tests are used for governing the quality of concrete for all types of concrete construction.

Compression tests, especially those made on field specimens, too frequently show a wide range in results and it is that fact which no doubt led to the present inquiry "Are Test Cylinders Indicative of the True Strength of Concrete in Structures?" But before considering the variables which can exist to produce low results or a wide range in test results, it might not be amiss to consider what compression tests on cylinders mean in terms of the compressive strength of concrete as it exists in the structure.

It probably is not generally realized that the shape of the compression test specimen greatly influences the compressive strength of concrete. In the United

States our standard compression specimen is a cylinder whose length is twice its diameter, and when the coarse aggregate has a nominal size of 2 in. and under, a 6 by 12 in. specimen is used. If the aggregate is larger, then an 8 by 16 in. cylinder is necessary, and an even larger diameter may be required for larger aggregate. The criterion is that the diameter must be at least 3 times the maximum nominal size of the coarse aggregate. That word "nominal" is to be noted. The ASTM uses the term "designated" size instead of "nominal" size and in concrete aggregate a 5 per cent tolerance above that size is permissible as determined by the testing sieve.

The use of a test specimen in the form of a cylinder whose length is twice its diameter is somewhat arbitrary. Not too many years ago, cubical specimens were used in this country, and many tests for compressive strength of concrete were made on 6 in. cubes by the Watertown Arsenal and other prominent testing agencies of that day. The cube is still used by a number of foreign countries and care must be exercised in interpreting test results to see that proper allowance is made for specimen size and shape. Test cores frequently are drilled from concrete pavements and the ratio of their length to diameter is not always 2:1, as required in the standard test cylinder, and so it becomes important to have a table of factors for translating the strength of these odd size specimens into that of standard cylinders. Such a table is given in ASTM Standard

\* Presented before the New York State Association of Highway Engineers, New York, N. Y., March 21, 1952

C 42-44, "Securing and Testing Specimens from Hardened Concrete," as follows:

Ratio of Length of Cylinder to Diameter ( $\frac{L}{D}$ )	Strength Correction Factor
1.75	0.98
1.50	0.96
1.25	0.94
1.10	0.90
1.00	0.85
0.75	0.70
0.50	0.50

Thus, for illustration, the strength obtained on a test cylinder 6 in. in diameter and 6 in. long would have to be multiplied by 0.85 to determine the strength in terms of the standard 6 by 12 in. cylinder. It will be observed from the table that as the ratio of  $\frac{L}{D}$  approaches 2.0, the strength correction factor approaches 1.0 and not much error in strength would occur, even with a large error, say of 1 in., in the standard length. A larger error would occur with changes in length, when the ratio of length to diameter is around 1.0. So, for this reason alone, the choice of  $\frac{L}{D} = 2.0$  for use in the standard cylinder is a logical one. It at least eliminates one possible source of error in the test results.

But what exactly does the compressive strength, as determined by a 6 by 12 in. cylinder, mean in terms of the strength of the concrete as it exists in the structure, assuming that the concrete is exactly alike in each case? If the structure is a column and has spiral reinforcement as well as longitudinal, the concrete is restrained from spreading laterally under load, but that is not so of the concrete in a test cylinder except at the ends where lateral restraint is provided by friction. There must, however, be other influences acting, for in extensive reinforced column investigations, it was shown that the compressive strength of a column is only about 85 per cent of the strength of the 6 by 12 in. control cylinders.<sup>1</sup> In a reinforced concrete beam, instead of there being uniform pressure distribution as in the test cylinder, there may be a parabolic distribution on the compression side above the neutral plane, and the rest of the concrete may be in tension, surely conditions quite unlike those in our arbitrary test cylinder. Offhand, there does not seem to be any relationship between the stress in our test specimen and the stress distribution in a concrete structure,

and from that viewpoint, we might just as well have chosen a differently shaped specimen. However, assuming a parabolic stress distribution in the compression portion of a reinforced concrete beam when near failure, and this is not a bad assumption, the computed strength of the concrete is very nearly equal to that of the control cylinder.<sup>2</sup>

We have many structures which are subjected to repeated loads and, so far as we know at the present time, the fatigue strength in compression may be only 50 to 60 per cent of the strength obtained by ordinary direct testing to failure by the use of our standard test specimen. We also know that when concrete is subjected to sustained loads which approach the ultimate strength as ordinarily obtained, the concrete will crush with a reduced load. Thus, the maximum load that a concrete structure will withstand indefinitely is less than the strength indicated by the standard test on a 6 by 12 in. cylinder.<sup>3</sup> On large mass construction the Reclamation Service has used 18 by 36 in. cylinders, and even 36 by 72 in. cylinders have been made, but the indications are that the strength of such cylinders is only about 80 per cent of the strength of 6 by 12 in. companion specimens.<sup>4</sup> So it is quite evident that when we speak of the compressive strength of concrete, we are dealing with a quantity which is a variable, depending upon how the test is made, and the test results may not indicate truly the compressive strength of the concrete in the structure, even though everything possible is done to treat the concrete in the test specimen in the same manner as that in the structure. This much is quite certain, there is at least a general relationship between the strength of the concrete in the structure and that in the test specimen, and so the compressive strength test becomes a useful tool for indicating the quality of the concrete.

#### Field Made and Laboratory Made Test Cylinders

Compression tests on concrete are made in the laboratory for determining the proportions required to obtain concrete of a given strength and workability, and also are used for control purposes in studies of a wide variety of other matters pertaining to con-

<sup>2</sup> W. E. Slater and Inge Lyse—"Compressive Strength of Concrete in Flexure as Determined from Tests of Reinforced Beams"; Proceedings, ACI, Volume XXVI, page 831, 1933

<sup>3</sup> R. H. Davis and H. E. Davis—"Flow of Concrete Under Action of Sustained Loads"; Proceedings, ACI, Volume XXVII, 1931

<sup>4</sup> Ruettgers—"Mass Concrete as Affected by Size of Aggregate and Related Factors"; Proceedings, ACI, Volume XXX, 1934

<sup>1</sup> W. E. Slater and Inge Lyse—"First Report on Column Tests at Lehigh University"; Proceedings, ACI, Volume XXVII, page 877, 1931

crete, notably its resistance to freezing and thawing and other properties. In the laboratory, very careful control can be exercised over all of those innumerable details which are concerned with the making, curing, and testing of the specimens, and when results are obtained from a well regulated laboratory, not much question can be raised as to their correctness.

The American Society for Testing Materials recognizes that there is a difference between the molding and testing of concrete cylinders in the laboratory and in the field. The laboratory molded and tested specimens should be used for a different purpose than the field molded specimens, whether these are tested in the laboratory or not. Obviously, in the laboratory, theoretically, ideal conditions of molding, curing, and testing are available. Weights of all the ingredients can be determined accurately, including the specific gravities and moisture contents of the aggregates and of the cement, curing conditions are set up which are ideal, and the temperature can be very carefully controlled so that there will be a minimum of variation; the conditions for capping and testing the specimens in the laboratory also are as good as can be obtained. Theoretically, then, the concrete specimens which are made and tested in the laboratory should show the strength of the concrete when treated in an ideal manner. The results thus obtained indicate the potential strength of the concrete. When concrete is to be designed, based upon test results, it is these laboratory made and tested specimens which should be used for this purpose.

In the field, the purpose of making test specimens is not at all to determine the potential strength which can be obtained, but rather to determine what strength actually is being obtained with the job concrete, which presumably has been proportioned according to the specifications, but which is subjected to all of the variations to which concrete in the field is subjected.

Field made compression specimens are used for two general purposes:

(a) One is to test the adequacy of laboratory design for the strength of the concrete as it is produced for the job. In this case, the specimens are cured in much the same manner as in the laboratory. ASTM Standard C 31-49, paragraph 7(b), calls for removing the specimens from the molds in 24 hours, storing them in a moist condition at a temperature between 65 and 75 F until the time of the test. Moist

condition is defined as that in which free water is maintained on the surface of the specimen at all times.

(b) Another purpose of field made specimens is for determining when the structure may be put into service, in which case specimens are removed from the molds at the end of 24 hours and stored in the structure as near to the point of sampling as possible and, further, they should receive, insofar as practicable, the same protection from the elements on all surfaces as is given to the portions of the structure which they represent. The idea is to expose the specimens to the same conditions as the concrete in the structure.

When the specimens are to be tested at the age of 28 days, they are sent to the laboratory not more than seven days prior to the time of test, and when other periods of test are used, the specimens are kept in the field at least three-fourths of the test period and, finally, while in the laboratory they are kept at laboratory temperature until 24 to 48 hours before testing, during which final period they are immersed in water at laboratory temperature. The idea of this final immersion is to bring the specimens into a wet condition because that is the accepted standard condition under which the strength should be determined. If tested dry they would give higher results than if tested wet.

It would seem desirable to make field specimens to accomplish both purposes, namely to determine if the concrete placed in the structure will actually develop the required strength when treated properly and, secondly, to determine as nearly as this is practicable, whether the concrete actually does attain the desired strength when treated as the concrete in the structure is treated. The first set of cylinders would determine the potential strength of the concrete and the second would determine the strength actually attained. The first set should be cured in an ideal manner as far as moisture and temperature are concerned; the second set should be cured like the concrete in the structure just as nearly as this can be obtained.

#### Variations in Compressive Strength

No doubt a number of you have been troubled in the past by test results on field concrete cylinders which vary widely and you wonder whether the concrete in the structure has the same variation or whether something has happened in the making, curing, and testing of the specimens which has

brought about this wide range in tests. To determine whether this range is due to the concrete itself, obviously, only those specimens which have been subjected to ideal curing conditions should be used. On the other hand, if these variations are caused by curing conditions, then this can be determined only by using the second set of specimens which are cured to simulate the curing of the concrete structure.

If there are defects in the testing procedure, these are very apt to show up in the form of low strengths. Accordingly, it becomes important to consider what are some of the matters which can affect the strength of concrete.

### Cylinder Molds

The Standard of the ASTM for field specimens, C 31-44, states that "all molds for compression test specimens shall be cylindrical in form, made of non-absorbent material, and shall be substantial enough to hold their form during the molding of test specimens." The molds are supposed to be provided with a metal base plate. The assembled mold and base plate must be water-tight.

It has become the practice in the field to use paraffined cardboard molds, and in the past this practice has been the source of some trouble. Paraffined molds are provided with a paraffined cardboard base and care should be exercised to place the mold on a flat surface and, even so, in all probability the base of the specimen, upon removal from the forms, will not be flat enough without the provision of the proper cap before testing. Even the best of paraffined molds are somewhat absorbent and some of these molds, upon taking up water, will expand as the water is absorbed from the concrete. Evidently there sometimes is sufficient adhesion between the green concrete and the sides of the mold to produce cracking in the concrete as expansion takes place, and this may be a source of low results.<sup>5</sup> One investigator has found that one type of paper mold absorbed 1/4 lb. of water per mold and another type, 3/10 lb. per mold. One type at the end of 24 hours, when filled with water, elongated approximately 0.16 in. and the other type, in the vicinity of 0.1 in. The most absorbent type of mold caused a reduction in strength of 12.3 per cent, and the less absorbent mold, 5.6 per cent, and even a greater loss in strength, up to 21 per cent, has been observed.

<sup>5</sup> "Tests of Paper Molds for Concrete Cylinders", by Robert A. Burmeister; September 1950 Journal of American Concrete Institute, page 17

Likewise, it was found that there was greater deviation from the average strength when the paper molds were used than when steel molds were used. Conclusions reached were that (1) concrete compression test cylinders made in paper molds show lower strengths than do those made in steel molds; (2) the reduction in strength is apparently due to cracks and mechanical injuries to the outer shell of concrete of the cylinder caused by movement of paper stock during the first 24 hours of curing.

However, all paper molds do not behave in this manner and another investigator has found just as high, if not a little higher, strengths in paper molds than in steel molds. It is quite evident that all paper molds are not satisfactory, and their absorption and expansion tendencies should be ascertained before adopting them for use in the field. At the present time, there is no standard for determining the adequacy of any particular type of paper mold and perhaps the best way of determining this before use is to obtain the relative concrete strengths of concrete made in steel and in the paper molds under consideration.

### Curing of Specimens

The curing to which specimens are subjected has an important influence on the strength of the concrete.<sup>6</sup> Concrete exposed to dry air from the time it is placed is about 42 per cent as strong in six months as concrete continuously moist cured. Specimens cured in water at 70 F were found to be stronger at 28 days than those cured in a fog room, by about 10 per cent. The amount of curing the concrete receives at the very beginning has a very great influence on its strength. For illustration, if the concrete is allowed to be in a wet condition for 3 days and then allowed to dry out, its strength at 28 days is less than when it is cured in water for 7 days before drying out. The longer the period of initial curing before drying out, the stronger will be the concrete, and if the concrete is kept continuously moist it will continue to gain strength, rapidly at first and then at a slower and slower rate. Thus, it is important that the field test specimens be cured exactly in the manner called for by the standards.

If the specimens are made for the purpose of checking the potential strength of the field concrete or as a basis for its acceptance, they are supposed to be removed from the forms at 24 hours and stored in

<sup>6</sup> "Factors Influencing Concrete Strength", by Walter H. Price; February 1951, Journal of the American Concrete Institute

a moist condition, that is, with their surfaces continuously wet, at a temperature ranging from 65 to 75 F until they are tested.

If, on the other hand, specimens are made for determining when the structure may be put into service or for gaining some idea of the strength of the concrete in the structure, they should be removed from the cylindrical molds at the end of 24 hours and then stored as nearly as practicable under identically the same conditions as the concrete in the structure. This is not always an easy thing to do, and the low results obtained from such cylinders may not at all indicate inadequacy of the concrete; they may have resulted from the way the concrete was treated during the curing period and this involves temperature conditions and amount of moisture the concrete in the specimens received. When such specimens are to be tested at 28 days, they should be sent to a laboratory 7 days prior to the time of test, and before testing in the laboratory, they should be immersed in water for 24 to 48 hours and tested in a moist condition. If they are tested dry, a false idea of the strength of the concrete will be obtained, because dry specimens, after their initial curing, are stronger than wet specimens.

#### Capping of Test Specimens

Perhaps there is nothing which will influence the strength of the concrete cylinder test specimens more than the caps which should be applied to both top and bottom, unless the specimen has been made in a metal mold on a metal base plate very carefully machined to have a flat surface within a tolerance of 0.001 in. Numerous tests have been made to determine the effect of lack of flatness of the top and bottom faces of the specimen, and it has been found that convexity of the cap by only .01 in. reduced the strength of the concrete specimen by as much as 35 per cent and .05 in. convexity, as much as 60 per cent. The high importance of obtaining end conditions which are as nearly perfect as possible must be quite evident.

Another matter which is frequently overlooked is the kind of capping material to be used. Standard test methods are very plain in requiring a cap which has at least the same strength as the concrete itself, but despite this requirement testing is still done by the use of blotting paper caps, which are practically useless, and by the use of plaster caps which are not allowed to harden sufficiently and which flow when the load is applied. It must be very evident that if

a cap is so soft that it will flow laterally when the load is applied that it must exert outward lateral force which tends to weaken the concrete. Caps made with neat cement are excellent when the cement is allowed to harden sufficiently, and so also is a strong plaster cap when made with high testing plaster. Sulfur compounds are regarded as being adequate, but just a word of caution here: sulfur caps are sometimes applied too thick and they are apt to shrink unequally; the result is an uneven cap which has nowhere near the proper degree of planeness.

#### Testing of the Specimens

##### *Bearing Blocks:*

When a concrete cylinder is tested after it has been adequately capped, care should be seen that the testing machine itself is in good condition. It is idle to provide hard, plane caps on the specimen and then put these ends in contact with steel surfaces which are, in themselves, not true. It is best to use a hardened steel base plate, which has been ground to a true plane, on which to mount the specimen. On top of the specimen there should be placed a spherical bearing block, whose face in contact with the specimen has likewise been ground to a true plane. These blocks periodically should be checked with a straight-edge to see that they are true, for, obviously, it is just as poor practice to use end plates in contact with the specimen which are lacking in planeness as it is to use caps on the specimen which are out of true. Many a testing laboratory operator has been surprised to find that for some reason his end plates by no means had a sufficient degree of planeness.

It should go without saying that the specimen should be so placed in the testing machine that it is exactly under the center of the spherical bearing block. If this is not done, there will be an eccentric load on the specimen, which produces higher stress on one side than on the other, and a low compressive strength is bound to result. The spherical block itself plays a very important part in the strength results obtained. The spherical block is made in two pieces, with the spherical surface in between. One half is supposed to slide easily over the other half. The block should be so designed that it is only slightly larger in diameter than the specimen, so that it will not be too heavy to be moved easily in adjusting itself to the top of the specimen. If the radius of the spherical surface of the block is large

and at the same time this spherical surface has been allowed to deteriorate through lack of care, actual tilting of the specimen can well result and a very low strength will be obtained.

#### *Testing Machine:*

The testing machine, naturally, must be in good condition. The old screw type of machine with long lever weighing mechanism was susceptible to inaccuracies if the knife edges were not kept clean, and calibration of the machine to test its accuracy should be made at intervals. Careful handling to keep the beam balanced during the application of the load is likewise necessary to prevent inertia effects, which can well apply a higher load than is indicated by the weighing mechanism. The newer hydraulic testing machines which have become almost universally used, likewise need calibration from time to time to insure their accuracy, and certain other precautions must be taken to check the condition of the weighing mechanism. Proper instructions are supplied by the manufacturer and should be carefully followed.

#### *Speed of Testing:*

The speed of operation affects the strengths obtained, especially if too high a speed is used. In the testing machines of the screw type, the moving head should travel at the rate of .05 in. per minute when the machine is running idle and in the hydraulic type of machine, the load should be applied at a constant rate within the range of 20 to 50 psi. per second. However, a higher loading rate can be applied during the first half of the test, and then the load adjusted to the proper rate during the last half. This saves time and does not affect the results.

#### **Selecting the Sample of Concrete**

Last, but by no means of least importance, is the securing of a fair sample for use in molding the test cylinders. If you are trying to get an idea of the general average strength of the field concrete you certainly should not select the sample from the soupy portion of the batch, but every effort should be made to obtain a fair sample which best represents the mass of concrete as a whole. If you are trying to see how much variation can exist, you obviously would select your samples to show the extremes, but that is usually not done for the reason that, except under the most flagrant violation of the

known rules of good proportioning, mixing, and placing, these extremes will not exist after the concrete is in place. Certainly they should not exist.

There are standards drawn up for sampling concrete which should be followed strictly to obtain a fair sample for test purposes. I refer you to ASTM Standard C 172-44. I shall not go into the details but, in general, the standard describes how to obtain a representative sample. It should go without saying that unless a fair sample is obtained every time, there will be a variation in the test cylinders even though the concretes sampled may be identical.

#### **Some of the Variables Affecting Concrete Strength**

A great many variables affect the strength of concrete and, although it is outside of the scope of this paper to discuss these variables, a few of them should be mentioned. Different types of cements produce different early strengths although they tend to approach each other in strength at later periods. At 28 days, Type 3, or high early strength cement, produces the strongest concrete; then comes Type 1, the cement which is normally used in concrete construction; then Type 2, the cement for moderate heat evolution. Types 1 and 2 are those most widely used, with Type 3 for special conditions requiring high early strength.

Nowadays we have air entrainment to contend with, generally used in Type 1 and 2 cements. Too high an air content will reduce the strength, especially when the cement factor is high, above 6 sacks per cu. yd. Air entrainment, however, may actually increase the strength of very lean concrete.

The finer ground cements produce higher early strength than the more coarsely ground. Then there is a variation in the strength of different brands of cement.

As already pointed out, the curing of the concrete has a very pronounced effect. The temperature at which the concrete is cured is important. Taking 70 F as the standard temperature of curing, concrete cured at 40 F has approximately 78 per cent of the strength of that cured at 70 F when tested at 28 days. Concrete cured at 115 F is only slightly higher, say about 5 per cent, than that cured at 70 F.

It is interesting to know that when specimens are cast at relatively wide ranges of temperature, held there for 2 hours and then finally cured at 70 F, the results are the reverse of those above stated, for it is found that under those circumstances specimens

which were cast at 40 F and held there for 2 hours and then finally cured at 70 F were much higher in strength than those cast at 115 F and held there for 2 hours and cured finally at 70 F. These results were obtained by the Bureau of Reclamation. They are quite in agreement with results obtained in the National Crushed Stone Association laboratory.

When the aggregates are hot from standing exposed to the sun and the cement is delivered to the job hot and these materials are placed in a transit mixer which has become heated under the action of the sun, it becomes necessary to add more water to attain a given slump than would be the case when the concrete is mixed at 70 F. Under such circumstances, to obtain the desired strength it may be necessary to add as much as one additional sack of cement because of the high amount of water required to produce the desired consistency. This is a fact which is frequently overlooked and it will account for low concrete strengths which are obtained under hot weather conditions.

Even though all precautions are taken to obtain uniform concrete on the job, and although this concrete is carefully sampled and tested according to accepted standards, it is not at all unusual to secure test results from laboratory cured field cylinders which have a very wide range. The Joint Committee on Concrete and Reinforced Concrete recognized this as inevitable as the result of a series of special field tests and when a given minimum strength is specified, they define failure to be as follows:

**Section 327—SA Definition of Failure.**

The specimens shall be considered to have failed when the average strength for any period of placing is less than the values indicated in the following table:

No. Days Consecutive Placing of any One Class of Concrete	Per Cent of Strength Specified in Section 301—SA
1	85
2	90
3	95
5 or more	100

The current ASTM Specification for Ready Mixed Concrete, C 94-48, requires uniformity as follows:

To conform with the requirements of these specifications, the average of all the strength tests representing each class of concrete, as well as the average of any 5 consecutive strength tests representing each class of concrete, shall be equal to or greater than the specified strength and no strength test shall have an average value less than 80 per cent of the specified strength.

In general, not less than 3 cylinders are used for samples of concrete and a given class of concrete must be represented by not less than 3 samples.

By using statistical methods and the theory of probability, it is possible to determine what the design strength should be "so that there will be reasonable assurance that no test, barring an unusual occurrence, will fall below a stated strength." This subject is too complex and too lengthy for consideration here, but it has been treated by Stanton Walker in the literature of the National Ready Mixed Concrete Association, and by Walter Price, of the U. S. Reclamation Service in his American Concrete Institute paper. (See Reference No. 6)

The subject matter of this paper "Are Test Cylinders Indicative of the True Strength of Concrete?" has many ramifications and no doubt it could be treated more fully.

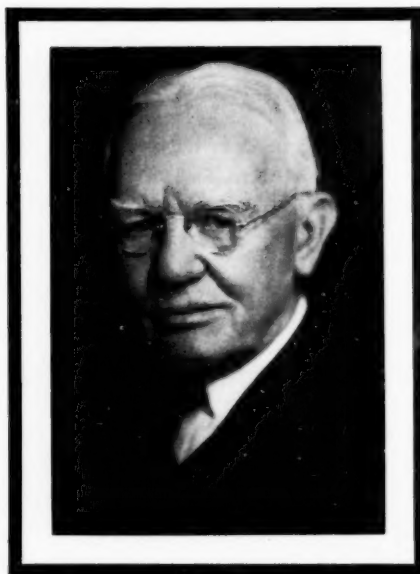
### Summary

Let me summarize by saying it is my belief that, in the field, too little attention is paid to the many details of procedure in sampling, molding, curing, and testing concrete. I believe that more frequently than not, concrete which complies with the Joint Committee or the ASTM criteria actually has the desired strength even though some of the test cylinders indicate otherwise. There, of course, are still too many cases in which the concrete actually is at fault, the common fault of too much mixing water. Finally, let me say that you simply cannot be too strict in your attention to the details of the required testing procedure. Test results are useless and misleading when incorrect testing procedures are used.

## Plans Progressing for NCSA Fifth Short Course

The response to our inquiry regarding the desirability of our holding the Fifth Short Course for Crushed Stone Salesmen on January 7, 8, and 9, 1953, in Washington, D. C., was decidedly favorable. Even at this early date, we have received word from 27 companies who probably will send approximately 90 employees to the course. Plans for the program are progressing and we hope to develop a final program of outstanding speakers to cover many subjects in the field of crushed stone.

Mark the above dates on your calendar. We will do our utmost to make the Fifth Short Course a reality in January, 1953.



1866

1952

## John Rice

### In Memoriam

**T**HE ENTIRE Crushed Stone Industry has sustained a severe loss in the death of John Rice, which occurred in the early afternoon of May 22nd.

While Mr. Rice had many friends throughout the industry, the members of the National Crushed Stone Association will miss him most because they knew him more intimately. He was one of the organizers of the Association in Chicago in 1917. His energy, enthusiasm, and foresight safely started the Association on the road which it has so successfully followed since. He infused into all of us something of his qualities of courage and vision.

Mr. Rice was elected President of the Association in Louisville, Kentucky, in 1920, being the second to hold that office. From the time of the formation of the Association until 1946 he served as an active member of its Board of Directors. Subsequently, he was made an Honorary Member, a position he held until the time of his death.

Through the early years of the life of the Association when it had difficult problems to solve, especially financial, Mr. Rice was quick to be of assistance and we always felt the helpfulness and resourcefulness which so clearly emanated from him. He was frequently referred to as the Dean of the Crushed Stone Industry, a characterization which he richly deserved.

John Rice was born in Pottstown, Pennsylvania, in 1866. One of his ancestors, John Potts, was the founder of Pottstown. His grandfather, also named John Rice, was one of the first Commissioners of Fairmount Park, Philadelphia, and a Director of the Pennsylvania Railroad. Mr. Rice was

graduated from the Hill School in Pottstown, in 1882, and from the Sheffield Scientific School of Yale University in 1885.

He was a leader in the civic life of Easton and was regarded as "Easton's first Citizen". He was one of the founders of The General Crushed Stone Company and was its President until 1931, at which time he became Chairman of the Board, and, later, Honorary Chairman of the Board. He was also President of the Hotel Easton Company and President of the Easton Trust Company. He actively participated in all forms of community social betterment, and was greatly beloved in his adopted city.

The National Crushed Stone Association valued not only his qualities of leadership but also his delightful companionship. Someone has said of him, he was too sincere and modest to realize his own greatness. We admired his qualities of character and to all of us he endeared himself by his sympathetic understanding and the desire to serve whenever and wherever he could be useful. John Rice was indeed a gentle man, considerate of others and of unfailing courtesy—one of nature's noblemen. His memory will live in our hearts and we shall continue to be grateful not only for his splendid service to the Association but, also, for the benefit to each one of us for having been associated with him.

He is survived by his son John Rice, Jr., Vice President of The General Crushed Stone Company, and by his daughter, Virginia Rice Love, of Washington, D. C.

# The Trade Association Executive and the Federal Government<sup>1</sup>

By HARRY P. CAIN

United States Senator from the State of Washington

I HAVE been impressed many times during my five and a half years in Washington as a United States Senator, with the fact that the trade association executive is an important and frequently unappreciated person who makes significant contributions toward the optimum functioning of our representative form of government.

I am therefore very happy to accept the invitation of the editors of the Journal of the American Trade Association Executives to set forth some of my thoughts on how trade associations and government can work together for their mutual benefit—and for the benefit of the nation.

It seems to me that no thinking person can disagree with the premise that it is vital to the national welfare for government and industry to work together effectively and harmoniously. This is especially true during times of great stress such as our present rearmament effort.

It seems to me that during the past twenty years, government and business have, to a considerable degree, lost confidence in each other. Without in any way injecting a partisan viewpoint into the discussion, I think it is evident to all that government—and I refer particularly to the administrative branch—has been pulling in one direction and business, by and large, in an opposite direction.

It has been largely through the efforts of trade associations and trade association officials that the conflicting philosophies have been reconciled to the extent they have. The public at large will probably never realize what a debt it owes to trade associations for this.

## The TAE An Interpreter

That, in my opinion, is the heart of the matter. The trade association executive's job is to explain the viewpoint and needs of his industry to government. Conversely, if he is to do a good job, he must interpret the needs and viewpoint of government to

his industry. The association executive doing a conscientious job realizes that this is a two-way street. His job is not exclusively to "sell" industry's desires to government. He must, as a civic-minded, fair-thinking man, realize that there are often occasions when the desires of his industry must yield to the welfare of all.

From personal observation I know that the most successful trade association leaders have this broad viewpoint.

It is my feeling that the government is greatly indebted to trade associations and without their cooperation it would be difficult for it to function effectively. Take as an example the function of supplying information about the industry which the normal trade association performs.

Consider this matter of information a moment if you will. Maybe you have never thought of it in this light before, but it takes hundreds of thousands—even millions—of facts to run a government. In my own case, as a legislator, I am constantly faced with the problem of determining what the facts are in a given situation. When unwise laws or regulations are made, it is generally because they are at variance with the facts.

## Constant Search For Facts

If we in Congress are to perform our function wisely and justly (and all of us, I think, at least try to do this) we are of necessity engaged in a constant and never ending search for facts. How will a given law react upon an industry? Upon the people who work in the industry? Upon the nation as a whole? The factors we must weigh in considering legislation go on and on, seemingly forever.

Pressing our example a bit further, we soon realize that our economy and our civilization are so complex that it is impossible for any legislator or administrator personally to know all about each of the matters he must deal with himself. It would be literally impossible for any man, had he the wisdom of Solomon and the patience of Job, and could work

<sup>1</sup> Reprinted from the *American Trade Association Executives Journal*, April 1952

seven days a week 24 hours a day, to find out, without help, all of the facts he must know as a responsible legislator.

The simple answer is, of course, that we must have help in obtaining basic facts in passing upon the problems which we face. A great many of these facts come from industry and from the trade association. I well recall, for example, how, during World War II, more than two thousand government-industry advisory committees were set up. This arrangement has, with some modification, been re-established during the present emergency.

#### **Supplying Facts Is Vital Job**

It is literally impossible for much of this necessary information to come from any place except from the industry involved, and since the trade association executive usually does the statistic-collecting for his industry, we come to the basic fact that the association executive makes a great contribution to the government by this one function alone. It has been truly said that trade associations make freely available to the government facts which the government would have to spend tens and hundreds of millions of dollars to collect were it to do the job itself.

But I do not think that the contribution the association executives make to the national welfare is limited to so mechanical a thing as supplying figures, even though that itself is a necessary and laudable task.

It is as the unofficial middleman between government and industry that the association executive is important.

To me, it seems ever more obvious that we must have more cooperation between government and industry if we are going to successfully meet the long series of crises and trials which seem to be in store for us for a long time to come.

#### **TAE Plays Important Role**

The trade association and the trade association executive have an important role to play in our political life—in various stages in the enactment of legislation, in adopting regulations under it, in its administration, and finally, in its improvement by amendment.

Let us quickly take a look at some of these steps. Perhaps, from my experience as a Member of Con-

gress, I may be able to bring out a few things which may be of help to you in your professional duties.

Undoubtedly, a discussion of the proper scope of relationships between Members of Congress and trade association executives would be of interest to readers of the *ATAE Journal*. Since government is increasingly getting into the concerns of business, it is only natural that business should increasingly concern itself with the business of government. This would be true if for no other reason than it is necessary for business to protect itself.

As a personal aside, let me say that we should all encourage the increased interest of businessmen in government. The active interest of the public in the affairs of government is the keystone of free government. If business, for example, had paid more attention to government at an earlier date, perhaps a great many things which we all disapprove might never have happened. I know that the participation of trade association executives in the legislative process and in the process of assisting in the preparation of administrative regulations under our laws has resulted in sounder laws and more workable regulations.

#### **Industry Has Right to Speak**

It is only natural that when a law is proposed that regulates an industry—or imposes some kind of restriction on it, or increases its taxes, or strikes at its source of raw material, or does any of the thousand and one other things which government can do to affect an industry adversely—it is only natural that the industry's leaders should become concerned about it and come to Congress to tell their story.

In spite of the efforts of some misguided newspaper columnists, professional bleeding-hearts, and others to paint as blackguard activity every attempt by business to gain what it conceives to be its rights before our legislative bodies, there is nothing subversive or underhanded about this. The right of any group to petition Congress and tell its story, and tell it effectively, to those who make the laws is a fundamental right guaranteed by the Constitution. It is in the best American tradition. The enemies of business apparently forget that the American Revolution was largely fought because our forefathers could not effectively petition the British Parliament.

Therefore, any leading trade association executive, whose business is to tell his story to Congress and the administrative agencies when the interests of

his industry are concerned, will often have occasion to tell his story to Congress.

How should he go about this?

#### **How Do You Tell Your Story?**

Well, as one who has sat through tens of thousands of pages of testimony before various Senate Committees, I have some definite impressions about how the persons and associations testifying could increase their effectiveness. Some of them, I'm afraid, will seem rather obvious and fundamental, but you would be surprised how often many prominent groups, including a great many who should know better, seem to forget them.

The first requisite would be that the association executive should be thoroughly prepared and know fully the subject he is talking about.

One might think that would be so elementary that it would not have to be mentioned, but it is not. Like all Members of Congress, I have often been forced to listen to long-winded, poorly prepared witnesses holding forth at length, in general terms, on matters far afield from the issue at hand.

If you are going to testify before a Senate hearing, *please* be well prepared.

#### **Be Brief, To The Point**

A second point is to be brief, specific, and avoid repetition. If another member of your group or an allied group testifies at length regarding a point, it is a consideration to all concerned to avoid laboring the same arguments at length. A simple statement of your position and the main reasons for it will suffice. Members of Congress generally try to be judicial in their attitude, weighing questions impartially on their merits as we see them and not be prejudiced against a proposition because its proponents have done a poor job of presentation for it.

But I must say it is sometimes hard to do. Too much talk can often kill a good impression. Many times I can recall having been at first favorably impressed by a witness, only to have his subsequent incoherence or lengthy discussion turn my initial good impression to resentment.

Perhaps I am dwelling too strongly on this point, but I assure you that it is a point upon which I feel strongly. Today, Members of Congress are faced with decisions on thousands of bills and they cannot afford to dissipate their time at long and sometimes boring public hearings. It is very much to your interest to make presentations lively, interesting, effective, and to the point.

#### **Reconcile Policy Differences**

A third rule I urge upon you, gentlemen, is that, wherever possible, you reconcile your own differences on matters of public policy before seeking the ear of government, particularly legislative groups. Too often a welter of dissenting opinions can cancel out the value of your counsel. This would seem to be another obvious point, but again, as with some other obvious things, it is often overlooked. So much for testimony at hearings.

The formulation of regulations under various Acts of Congress is another matter in which industry and trade association groups have historically been most helpful. The enactment of a law, as all but the most naive realize, does not automatically put a program into effect or a policy or prohibition into operation. The interpretation and administration of the law are probably nearly equal to its terminology in importance.

Of equal importance is the need to offer to keep the Congress itself informed of the manner in which its laws are applied by the Executive Departments of the Government, the result of the administrative interpretations on business and industry. This is an essential source of information to help strengthen our constitutional system of checks and balances. This is especially true in a period when the executive machinery might be dedicated to tearing down some aspect of our economic or political system through administrative action based on a maladministration of the laws.

#### **Realistic Regulations Needed**

It is no secret that, historically speaking, many a law has been distorted and perverted far away from its original intent by faulty interpretation and administration. Under the complex statutes we commonly deal with today, it is absolutely vital that a common-sense and realistic series of regulations be promulgated.

In this important work, the nation owes a great debt to the trade association executive.

Cooperation with administrative agencies in formulating regulations that take into consideration the realistic facts of our industrial life is one of the most important functions of the trade association. It results in better enforcement and obedience to the law, allowing its objectives to be met with a minimum of disruption to the normal activities of industry.

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1901



1952

## Henry A. Huschke

### In Memoriam

**I**T IS with a deep and shocking sense of loss that we report the sudden and untimely death of Henry A. Huschke on May 4, 1952. Until its dissolution at the end of 1951, Mr. Huschke was Managing Director of the Agricultural Limestone Institute, a Division of the National Crushed Stone Association.

In April of 1951 Mr. Huschke suffered a slight heart attack in the office, was briefly hospitalized, and after a further recuperation period at home seemed well on the road to recovery. A second and nearly fatal attack occurred in February of this year. He again seemed to be making slow but satisfactory progress at home. The end came on May 4, at the Arlington Hospital, Arlington, Virginia, where he was taken following a third attack on the evening of May 3.

Through his six years with the Agricultural Limestone Institute, "Hank", as he was affectionately known to his many friends in the industry, rendered a highly valuable service to agricultural limestone producers through his development of distinctive and effective promotional material and through his activities with the legislative and administrative branches of the federal government.

Mr. Huschke was a native of New York City, graduated from Cornell University in 1922, and came to Washington in 1930 as an agronomist with the National Lime Associa-

tion. He was loaned to the Office of Price Administration in 1942 where he remained until 1945, then becoming Managing Director of the Agricultural Limestone Institute.

He served with the Institute, a Division of the National Crushed Stone Association, until he was loaned to the Office of Price Stabilization in July of 1951 where he was employed at the time of his death, the Institute having been dissolved at the end of that year.

Hank's warm and friendly personality, his integrity, and high sense of moral right, his wholesome philosophy and ever present sense of humor, endeared him to all who had the very real privilege of knowing him. We enjoyed this privilege to an unusual degree and will always cherish the fondest of memories for him who was ever cheerful, ever sympathetic, and ever alert to lend a helping hand.

Mr. Huschke was a member of the Washington Trade Association Executives, past master of Sharon Masonic Lodge No. 327, McLean, Virginia, and past patron of Sharon Chapter 63, Order of the Eastern Star.

He is survived by his wife, Mrs. Hedwig Huschke; a son, Ralph E. Huschke; a daughter, H. Elaine Huschke; his mother, Mrs. Wilhelmina B. Ebert of Hurleyville, New York; one brother and two sisters.

Deep and heartfelt sympathy is extended to his family in their bereavement.

# The Crisis in Highway Transportation<sup>1</sup>

By PYKE JOHNSON

President, Automotive Safety Foundation  
Washington, D. C.

**T**HAT NOISY, nerve-wracking traffic jam you see and hear from your office window is rapidly getting worse. Each day, as the volume of movement over roads and streets goes higher—it has nearly doubled since 1945—traffic delays, congestion and accidents also increase.

If you are one of the million who battles his way to and from the shop or office each day in a bumper-to-bumper snarl, you are painfully familiar with the problem, at first hand.

But, more than personal irritation or inconvenience is involved. Traffic conditions have deteriorated to a point where they constitute a real transportation crisis. Needless economic losses run into billions of dollars annually. What is worse, the traffic jam symbolizes the serious impairment of a service vital to the productive strength of the nation.

I appreciate this opportunity to report to you on the status of the problem; inefficient and costly transportation obviously has a direct impact upon your own business operations. Beyond that, you are concerned with it as public-spirited civic leaders, whose leadership is essential to a solution.

Your leadership is particularly needed today, because transportation policies are being formulated in Washington which ignore the profound changes motor vehicles have brought about in our way of living and of doing business. Horse-and-buggy standards are being applied to far-reaching problems of the motor age.

## Role of Highway Transport

The Brookings Institution recently pointed out that highway transportation is the greatest single combination of economic activities in man's history. The industries and related business enterprises which sustain it—such as automotive, petroleum, rubber and trucking—generate about one-seventh of all the gainful employment in the nation. Investment by the public in highway transportation this year will total approximately \$40 billion. Ninety per cent

roughly is for movement, ten per cent for roadbed.

The rolling stock for this system consists of 52 million passenger cars, trucks, and buses, owned or operated during the year by approximately 65 million adult Americans.

## Phenomenal Increase Since War

Of this staggering total, 19,000,000 vehicles have been added since the war, with the result that we now have more vehicles on the road than the most optimistic forecasts of a few short years ago said we would have by 1960. We are ten years beyond schedule in rolling stock as we are ten years behind in the roadbed.

Most significant in this phenomenal growth is that trucks have increased 100 per cent in that period from 4,500,000 to 9,000,000. Further, where the heaviest truck in the early twenties was 7½ tons, vehicles carrying four or five times that amount are numerous today. You sitting here today and other executives are responsible for that increase. Some may question whether passenger cars are used for "pleasure" driving. Certainly no one will say that of the truck!

The roadbed consists of 3 million miles of rural roads, and some 300 thousand miles of city streets. About one-half of this total will carry all-weather traffic.

When you consider the amount of travel over these roads and streets—it has been increasing by leaps and bounds every year—millions and billions are not big enough. The 1951 movement is estimated at one-half *trillion* vehicle miles—an almost inconceivable figure. Half of that terrific mileage moves over our city streets!

But automotive transportation is much more significant for what it *does* than for what it *is*. With something like two and a half times as many motor vehicles as the rest of the world combined, the United States has become, literally, a "nation on wheels." In the span of four decades, the use of these vehicles has become integrated, completely and irrevocably, with all phases of our economic and social life. They are technology's supreme mass

<sup>1</sup> An address delivered to the National Association of Manufacturers, Boca Raton, Florida, January 25, 1952

contribution to that freedom of movement for the individual, which is so essential to the American way of life.

#### **Not Recognized as Defense-Supporting**

It is these fundamental facts which some governmental policy makers are either unable or unwilling to recognize. For example, they have cut back steel allocations to highway projects from 2 million tons, which is the estimate of annual needs, to about 800,000 tons, a reduction substantially greater than was applied to other forms of transportation.

At the last meeting of the American Association of State Highway Officials, it was reported that 680 highway projects involving \$300 million in construction were then being held up by delayed steel deliveries. The sharpest pinch is in large cities, where highway construction, dollar for dollar, requires twice as much steel as in rural areas. Movement of traffic already is hampered on heavily-traveled arteries in some production centers, and if the policy is continued, inevitably there will be serious impairment of road transport generally.

The same attitude was reflected by defense authorities in Washington recently when they announced cut-backs on motor vehicle production below the level necessary to sustain defense transportation.

Annual passenger car output already has been cut to 4 million units. Under that program, the automobile industry would save in 1952 more than five million tons of steel, as compared with 1950 production. Now it is proposed to reduce the quota to a rate of 930,000 for the second quarter, with material allotments so much lower that this figure may not be attained.

This action was taken in the face of a report by the Brookings Institution that the lowest annual production of cars consistent with minimum defense needs is 4 million units. The report was based on a study made for the Defense Administration, and added that if the availability of materials permitted, a large volume of production would be desirable.

Like all other real Americans, the leaders of the automotive industry are prepared to make every sacrifice to aid the national defense. But controls of this sort, they believe, will not add a single gun, a single tank, a single airplane to the defense program.

The only result, in their judgment, is dislocation which is already forcing unemployment and hardship upon thousands of workers and which can cut essential transportation services below safe limits.

It is apparent that someone fails to grasp the meaning of these facts:

On an average winter day in this country, some 42 million people ride to and from work in automobiles or use them for shopping, in connection with their jobs, or in farming activities. In addition, 17 million people use their cars the same day for social and recreational travel.

Crops and livestock move off the farms to market or to railheads by truck—and supplies are hauled back the same way. Raw materials and manufactured goods move over roads and streets—the entire distribution system, wholesale and retail, is geared to transport and delivery by motor vehicle.

Rail, air and water services could not perform without the road and vehicle.

#### **Movement Vital to Defense**

Nor is automotive transportation solely a peacetime service. On the contrary, it is highly essential to a defense or war economy. During World War II, surveys showed that approximately three-fourths of the employees in war plants were using automobiles to get to work. Others relied on buses, running over the roads.

Since the war, dependence upon highways has further increased, due to an enormous expansion in vehicle registration and use, and a further decentralization of cities and of industries.

The extent of this dependence recently was pinpointed by a study of a typical defense plant, made by a large manufacturing company. It was found that of 13,469 employees, 13,000 reached the job by automobile, 280 by bus. The other few walked! Only 6,000 reside within the city in which the plant is situated. The other 7,000 workers drive each day from communities as far away as 89 miles. (Three actually drive that distance.) Five thousand workers live outside the city but within a radius of 30 miles from the plant. The other 2,000 reside in zones beyond the 30-mile point. Ninety per cent of all freight out of the factory moves by truck; forty-eight per cent of the inbound movement comes the same way.

#### **Road Modernization Urgently Needed**

The most difficult problem confronting highway transportation today is the modernization of the road plant. Highways are woefully inadequate. They lack capacity. Much of the safety problem has its

roots in outmoded design. Public Roads Commissioner Thomas H. MacDonald, outstanding leader in this field for more than 30 years, reported recently that the accumulated deficiencies on principal state routes now total 74,000 miles, and are growing by 5,000 to 6,000 miles per year.

During the next decade, about half of our existing main roads will wear out—many of them already are functionally obsolete.

#### **Congestion Acute on Main Arteries**

Traffic concentrates on a relatively small mileage of highways—86 per cent of rural travel, for example, occurs on less than a fourth of the road mileage. These main arteries, both rural and urban, including some which were the first to be built, are where the congestion problem mainly lies. Major routes in metropolitan centers are hopelessly inadequate for today's heavy concentrations of travel.

Theoretically, as worn-out or obsolete roads are replaced each year by new projects, the system is gradually modernized. But the replacement program was lagging even in 1940, when 34 million vehicles were in service. A backlog of deficiencies had piled up during the years of depression. Then came the road moratorium in World War II, and further depreciation of the plant. Meanwhile, traffic has sky-rocketed to unprecedented levels, compounding the chaos.

Inflation has aggravated the problem. Road construction costs have doubled in the past decade, with the result that the 1951 program, in terms of actual work accomplished, was only about the same size as that of 1931—far short of even bedrock requirements. The added costs since 1945 alone represent, in dollars, one whole year's federal aid improvement program.

Detailed studies made during the past few years by engineers of our organization, in cooperation with the highway officials of nine representative states, show that even a greatly stepped-up construction program would take at least 15 years to catch up with transportation needs. The states surveyed contain a fourth of the nation's total road-mileage, and 30 per cent of the vehicles.

A striking measure of the problem is the fact that the mileage of highways improved during the last two years would not accommodate, bumper-to-bumper in a single lane, the new motor vehicles that rolled off the assembly lines in that same period!

#### **Parking a Major Problem**

Closely related to the lack of roadway capacity is the growing shortage of off-street parking facilities. The best highway in the world is worthless without terminal facilities. Only a few cities, notably Pittsburgh and Baltimore, have undertaken large-scale and vigorous programs to meet this problem. Parking is peculiarly a local responsibility, but it is of major consequence to the usefulness and economy of the urban highway transportation system.

#### **Accident Losses Are Intolerable**

Highway accidents constitute a third primary element of the transportation crisis. In December 1949, a sharp downward trend in highway fatalities was reversed. In 1949 the total was 33,500. In 1950 it was 35,000. Last year it was 35,700 with 1.3 million injured, thousands of them permanently crippled. The property loss was \$3.5 billions, far more than our annual highway construction program. The effect on production was the loss of 489,000 man years!

Why? The date of change was pre-Korea. The "rate" of loss of life per 100 million miles of travel was at a low point. Education and enforcement methods had vastly improved. The only significant change I know of was the constantly increasing exposure resulting from constantly increasing movement over outmoded roads and streets.

December, 1951 witnessed the millionth traffic fatality—one million deaths in half a century. Unless the trend is checked, 1952 will bring the most deaths in U. S. history, and a rate which, if continued, would result in 2 million fatalities during the next 50 years.

I have already mentioned the billions wasted through accidents, in lost wages, medical expenses and related losses. Traffic congestion and delay due to inadequate facilities impose other losses at least equally large. They cause excessive transportation expense, which is reflected in higher cost of manufactured goods. They disrupt production and distribution schedules, and strangle cities with economic paralysis, causing ruinous depression of land values.

#### **Large-Scale Road Program is Needed**

What needs to be done?

1. Clearly, an expanded road construction program, geared to transportation requirements, is urgently needed. Modernization must be stepped up to prevent further depreciation of the highway plant.

2. The responsibility for this job is shared by more than 33,000 federal, state, county, municipal, and township agencies. The upgrading of highway administration is therefore a basic element in the solution. Archaic highway laws, inherited from the 19th century, must be brought up to date so that administration and financing can be done on a business-like basis. Construction programs must be put on an orderly, long-range basis, determined by engineering analysis rather than by political expediency.

3. The situation calls for comprehensive engineering studies of needs, state by state, followed up in each case by needed enabling legislation. With highway expenditures for the next two decades variously estimated at from \$5 to \$7 billion a year, obviously this is a matter of considerable consequence to the entire economy. We can't permit billions to be boondoggled.

4. Lurking in the near background is the problem of money. Roads must be paid for. There is urgent need for an over-all highway financing policy and continuing fiscal studies by every state. Capital investment should be segregated from current expenditure where economically justified. Piecemeal tax increases won't meet today's necessities.

We are concerned not with the problem of an individual who wants another suit of clothes but can't afford it, but with the making of an investment necessary to keep the plant in operation at the lowest cost which it is not doing today.

First of all, we must understand that unlike some types of public works, highway transportation is self-liquidating. Dedicated to the purposes for which they were enacted, special highway taxes of today are sufficient in amount to offset present expenditures for "general purpose roads."

But this is not being done. While 21 states prohibit diversion to non-highway purposes, the remaining states yet diverted about \$200 million last year—an indefensible record of inequity. Land service roads and streets should be paid for by the land they serve.

Some states since the war, in order to get urgently needed main roads quickly, have resorted to revenue financing, with borrowed funds secured by the collection of tolls. This is getting facilities the expensive way—toll charges are equivalent to gasoline taxes ranging from 15 to 60 cents per gallon. Nor is this a general solution to the problem, since the application of toll financing necessarily is limited to a relatively small mileage of the most heavily traveled arteries.

Toll roads are impractical in the urban areas where the problem is most severe. But the trend points up the public impatience with progress in the highway program—and underscores the willingness of people to pay for safe and efficient roadways.

### The Role of the Federal Government

Comparatively few Americans are familiar with the unique role performed by their federal government in the highway field. A working partnership between Uncle Sam and the states, in effect for 30-odd years, has produced a great highway system, rendered obsolete only by the amazing traffic revolution.

The basic law was first enacted in 1916, and amended to substantially its present form in 1921. Through its passage, Congress recognized the constitutional obligation of the federal government to help provide postal routes and other roads necessary to national defense and the general welfare. Thus, highway funds never have been federal "grants" in the usual sense of that term. Authorizations are apportioned among the states by set formulae (to eliminate log-rolling), and matched 50-50 by the states (except in public land states where matching varies with government holdings of land).

Each state retains complete sovereignty over its road program. The state initiates, plans and operates its own highways, utilizing private contractors for construction. Federal funds are paid afterwards in the form of reimbursements (for construction only) on approved federal-aid projects.

Thus Uncle Sam possesses only a veto power, and can use that only on projects on which a state wishes to apply matching funds.

Within these sharply limited federal powers, the program has proved to be a vital influence in the upgrading of highway administration. One reason is that Congress restricts Federal funds to projects meeting rigid specifications, located on systems of roads, designated and approved in advance. This has resulted in a concentration of highway expenditures on road *systems*, with incalculable savings of highway tax dollars.

Funds can be withheld from a state only for specific departures from the law. These include failure to provide a competent engineering organization in the state; failure to protect the road investment by adequate maintenance; and the diversion of highway revenues to non-highway purposes (if di-

version exceeds that existing in 1934 when this feature of the law was enacted).

#### **Continuance of Cooperative Program Indispensable**

Over the years, the federal share of the total U. S. highway budget has averaged 14 per cent. Current authorizations by Congress, however, represent about 10 per cent of the total highway expenditures. If this country is to hold the line on dispersion and diversion of road revenues during the period ahead of expanded construction, the restraints exercised by the federal law must be maintained. The funds are necessary, too, to meet the national interest.

To give the states advance notice of federal-aid policy, so they can enact necessary legislation and make administrative plans, the Congress now in session will take up shortly the question of highway authorizations for the two fiscal years ending July, 1954. Defense officials have stated that the materials shortages now hampering construction will have been eliminated by the time funds authorized by this Congress become available.

It would be a tragic and irrevocable error if this program were to be confused with any other quite different types of federal-aid legislation.

One of the thorniest fiscal issues ahead is confronted by the Congress itself, which, during the depression, began to levy "emergency" taxes against vehicles, tires and petroleum products. These revenues in 1952 are expected to total \$2 billion, compared with current federal authorizations for highway purposes of only one-fourth that amount. In practical effect, therefore, the Congress is guilty of large-scale diversion of highway revenues—the very evil it has legislated against in state practice.

#### **Road Funds Are An Investment**

This matter, like other highway issues, deserves critical attention by informed leadership.

In the final analysis, safe and efficient highway transportation will be achieved only when we get a full dollar's return for each dollar invested in the roadbed. That means better government, in a field where billions are at stake every year.

It means informed and aggressive leadership by interested citizens, and especially by those directly concerned with transportation, based upon a full realization as to what the movement of motor vehicles means to our way of living and to our business economy.

The traffic jam has reached this critical state at a time we can least afford it. Unnecessary costs of

doing business hurt more today than ever before. Finally, efficient transportation is essential to the task of strengthening and sustaining an economy dedicated to national security.

The jam can be broken by sound policies and resolute action. It must and will be broken, nothing else is conceivable. From the record of the past, I am confident that you, as leading business executives, will do your full part and more in meeting this challenge.

### **Sufficiency Ratings Key to Highway Adequacy**

The use of Sufficiency Ratings to measure highway adequacy was praised highly during a panel discussion of the Fourth Highway Transportation Congress. The Sufficiency Ratings mechanism was particularly lauded as a factor in promoting public support of highway improvement programs.

Participants in the discussion, over which Roy E. Jorgensen, NHUC engineering counsel, presided as moderator, included Carl E. Fritts, vice president in charge of engineering of the Automotive Safety Foundation; Walter W. Graf, city engineer of Lancaster, Ohio and past president of the Ohio State Automobile Association; Frank N. Barker, chief highway engineer of the Illinois Division of Highways, and O. L. Kipp, assistant commissioner and chief engineer of the Minnesota Department of Highways.

In opening the panel, Mr. Jorgensen said that "the Sufficiency Ratings idea is now used in about 20 states and by the U. S. Bureau of Public Roads."

#### **Officials Like Method**

Mr. Graf described the sufficiency rating technique as "one of the most important highway engineering tools developed in recent years."

Mr. Fritts told the Congress delegates that "the sufficiency rating idea becomes a most effective corollary to other phases (of measuring road needs) and fills a long-standing gap in the process."

Mr. Barker said that in his state of Illinois "we consider it (the sufficiency ratings method) an invaluable administrative tool."

Mr. Kipp revealed that studies made during the past year by the Subcommittee on Sufficiency Rating Formulas of the Highway Research Board Committee on Highway Costs have led to the development of a sufficiency rating procedure in Minnesota.

## Virginia Study Shows Economic Importance of Roads

**J**UST how vital highways are to one state's economy has been graphically set forth and carefully documented in a recent engineering appraisal of Virginia's principal roads and streets. The study, titled "Highway Needs in the Emergency," was prepared jointly by the Automotive Safety Foundation, the Virginia State Department of Highways, and the U. S. Bureau of Public Roads.

Virginia's four basic manufacturing industries, the study points out, are tobacco, chemical and allied products, textiles, and food products. All are served by and are dependent upon highway transportation.

Tobacco also is traditionally one of Virginia's leading "cash" agricultural commodities. The appraisal finds that more than 70 per cent of Virginia's tobacco is moved by truck before it is finished at the factory. And three-fourths of the manufactured tobacco products are transported by truck.

To illustrate the volume of truck movement in Virginia the study points to the fact that, in 1950, 2,316 tractor-trailer combinations were operating on U. S. Highway No. 1, north of Richmond, per 24-hour period. These units combined to average a total net load of more than 16,000 tons daily.

As much as 76 per cent of the small manufacturers in the state move half or more of their outbound products over the highways, it was reported. Approximately half also receive more than 50 per cent of their inbound goods by truck.

Virginia is basically agricultural. One of its principal crops is green corn. In a survey of 12 major eastern markets, it was found that 95 per cent of the green corn from Virginia came in by truck.

The Old Dominion's 478,000 milk cows provide raw milk which is hauled entirely by truck to processing plants in the principal cities. Milk then goes to consumers by truck, in many cases moving over the roads to the several military and naval installations in Virginia.

Virginia farmers depended on their highways for the initial movement of 100 per cent of their livestock, and to a large extent for reshipment of it. And of all types of Virginia produce shipped to four leading eastern markets . . . Boston, New York, Philadelphia and Atlanta . . . 93 per cent moved by truck.

The study goes on to point out that there are in Virginia numerous industries essential to the na-

tional defense program. These industries are greatly dependent on highways for day-to-day movement of personnel, raw materials and manufactured products.—*Highway Highlights.*

## The Trade Association Executive and the Federal Government

(Continued from Page 13)

### Congress Depends On TAE

Let us be perfectly frank: The Congress would be virtually helpless—or at best very badly crippled—in its work of writing and rewriting the laws of the country if it did not have available to it private sources of information. Among the most important of these sources are the trade associations and their executives. The charge has been made that this kind of help and advice stems from "selfish motives." That may be true. But it has been shown clearly that it is the "selfish motive" of Americans to have a better country, a higher standard of living, greater political freedom which is responsible for the high level which we have reached.

In this connection, the work the Advisory Council on Federal Reports, made up in large part, I believe, by members of the American Trade Association Executives group, is a signal contribution. The elimination of useless forms and reports doubtless results in savings of many millions of dollars annually to both industry and government and allows manpower which would otherwise be spent on them to be channeled into more productive fields.

Finally, there is the matter of improving the law. Experience has shown that statutes are not always perfect or near perfect immediately upon their enactment. It takes time and experience in operation to learn wherein they fail and must be improved. In bringing to the attention of Congress their knowledge of the first-hand workings of laws which affect them, trade association executives perform another valuable service.

In closing, let me say that I feel that the trade association executive is an important man in our civilization, and I look for his importance to increase as our interdependent life becomes increasingly more complex. Let me enjoin upon you devotion to public service in its highest and best sense. For the association executive who best serves the long run public interest will find he is best serving himself and his industry.

## Manufacturers Division—National Crushed Stone Association

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

### Allis-Chalmers Mfg. Co.

Milwaukee 1, Wis.  
Crushing, Screening, Washing, Grinding,  
Cement Machinery; Motors; Texrope  
Drives; Centrifugal Pumps; Tractors

### American Cyanamid Co.

Explosives Department  
2527 Oliver Bldg., Pittsburgh 22, Pa.  
Explosives and Blasting Supplies

### American Manganese Steel Division

#### American Brake Shoe Co.

109 North Wabash Ave., Chicago 2, Ill.  
Manganese Steel Castings, Power Shovel  
Dippers, Material Handling Pumps, Heat  
and Corrosion Resistant Castings, Recla-  
mation and Hard-Facing Welding Ma-  
terials

### American Pulverizer Co.

1249 Macklind Ave., St. Louis 10, Mo.  
Manufacturers of Ring Crushers and Ham-  
mermills for Primary and Secondary  
Crushing

### American Steel & Wire Div.

Rockefeller Bldg., 614 Superior Ave., N. W.,  
Cleveland 13, Ohio  
Wire Rope, Aerial Wire Rope Tramways,  
Electrical Wires and Cables, Welded Wire  
Fabric, Concrete Reinforcing, Wire Nails,  
Fencing, Netting

### Atlas Powder Co.

Wilmington 99, Del.  
Industrial Explosives and Blasting Supplies

### Austin-Western Co.

601 N. Farnsworth Ave., Aurora 1, Ill.  
Jaw and Roll Crushers, Conveyors, Feeders,  
Screens, and Bins—Separately or Com-  
bined in Complete Crushing, Screening  
and Washing Plants; All Types of Dump,  
Hopper, and Quarry Cars, Air and Elec-  
trically Operated, in Narrow and Stan-  
dard Gauges; Power Shovels, Drag Lines,  
and Cranes; Road Making, Earth Han-  
dling, and Street Cleaning Equipment

### Bacon-Greene & Milroy

205 Church St., New Haven 10, Conn.  
"FARREL-BACON" Jaw Crushers for Pri-  
mary and Secondary Operations, Convey-  
ors, Elevators, Rolls, Screens

### Bacon-Pietsch Co., Inc.

149 Broadway, New York 6, N. Y.  
Manufacturers of Farrel-Bacon Crushers  
and Allied Screening and Conveying  
Equipment

### Baldwin-Lima-Hamilton Corp.

#### Construction Equipment Division

South Main St., Lima, Ohio  
Power Shovels, Draglines and Cranes

### Barber-Greene Co.

631 West Park Ave., Aurora, Ill.  
Portable and Permanent Belt Conveyors,  
Belt Conveyor Idlers, Bucket Loaders  
both Wheel and Crawler Mounted, As-  
phalt Mixers and Finishers, Coal Hand-  
ling Machines

### Buchanan, C. G., Crushing Machinery Divi- sion of the Birdsboro Steel Foundry and Machine Co.

1941 Furnace St., Birdsboro, Pa.  
Primary, Secondary, and Finishing Crushers  
and Rolls

### Bucyrus-Erie Co.

South Milwaukee, Wis.  
Excavating, Drilling and Material Handling  
Equipment

### Buda Co.

154th St. and Commercial Ave., Harvey, Ill.  
Diesel and Gasoline Engines; Material Han-  
dling Equipment; Lifting Jacks; Earth  
Drills and Maintenance of Way Equip-  
ment

### Caterpillar Tractor Co.

Peoria 8, Ill.  
Track-Type Tractors, Bulldozers, Earth-  
moving Scrapers, Motor Graders, Heavy-  
Duty Off-Road Hauling Units, Diesel  
Engines, and Diesel Electric Generating  
Sets

### Chain Belt Co.

P. O. Box 2022, Milwaukee 1, Wis.  
Rex Conveyors, Elevators, Feeders, Idlers;  
Drive and Conveyor Chains, Power Trans-  
mission Equipment; Concrete Mixers,  
Pavers, Pumpcrete and Portable Pumps

### Construction Equipment

205 East 42nd St., New York 17, N. Y.  
"The Equipment Application Magazine"

### Continental Gin Co.

4500 Fifth Ave., S., Birmingham 2, Ala.  
Conveyors—Belt, Screw, Flight, and Under-  
ground Mine; Elevators—Bucket and  
Screw; Feeders—Apron, Belt, Reciprocating,  
Table, and Screw; Drives—V-Belts,  
Chains and Sprockets, Gears and Speed  
Reducers

### Cross Engineering Co.

P. O. Box 16, Carbondale, Pa.  
Screen Plates and Sections, Perforated Plate  
for Vibrating, Rotary and Shaking Screens

## Manufacturers Division—National Crushed Stone Association (continued)

### Cummins Engine Co., Inc.

Fifth and Union Sts., Columbus, Ind.

Lightweight Highspeed Diesel Engines (50-550 Hp.) for: On-Highway Trucks, Off-Highway Trucks, Buses, Tractors, Earthmovers, Shovels, Cranes, Industrial and Switcher Locomotives, Air Compressors, Logging Yarders and Loaders, Oil Well Drilling Rigs, Centrifugal Pumps, Generator Sets and Power Units, Work Boats and Pleasure Craft

### Deister Machine Co.

1933 East Wayne St., Fort Wayne 4, Ind.

Deister Plat-O Vibrating Screen, Deister Compound Funnel Classifier

### Detroit Diesel Engine Division

#### General Motors Corp.

13400 West Outer Drive, Detroit 28, Mich.

Light Weight, Compact 2 Cycle Diesel Engines and "Package Power" Units for All Classes of Service

### Diamond Iron Works, Inc.

1728 N. Second St., Minneapolis 11, Minn.

Jaw and Roll Crushers; Vibrator, Revolving, and Scrubber Screens; Drag Washers; Bucket Elevators; Belt Conveyors; Bins; Apron and Plate Feeders; Portable Gravel and Rock Crushing, Screening, and Washing Plants; Stationary Crushing, Screening, and Washing Plants; Hammermills

### Du Pont, E. I., de Nemours & Co., Inc.

Wilmington 98, Del.

Explosives and Blasting Accessories

### Eagle Iron Works

129 Holcomb Ave., Des Moines 13, Iowa

Fine Material Screw Washers—Classifiers—Dehydrators; Coarse Material Screw and Log Washers—Dewaterers; Water Scalping and Fine Material Settling Tanks; and "Swintek" Screen Chain Cutter Dredging Ladders

### Easton Car & Construction Co.

Easton, Pa.

Off-Highway Transportation: Dump Trailers, Truck Bodies, and Cars for Mines, Quarries, and Earth Moving Projects

### Ensign-Bickford Co.

Simsbury, Conn.

Primacord-Bickford Detonating Fuse and Safety Fuse

### Euclid Road Machinery Co.

1361 Chardon Road, Cleveland 17, Ohio

Heavy-Duty Trucks and Dump Trailers for "Off-Highway" Hauls, Loaders for Earth Excavation

### Even Spread Co.

P. O. Box 98, Owensville, Ohio

Power Spreaders and Attachments for Agricultural Lime and Fertilizer

### Frog, Switch & Mfg. Co.

Carlisle, Pa.

Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches, and Crossings, Jaw and Gyratory Crushers, Cement Mills, Mining Machinery, Etc., Steam Shovel Parts

### General Electric Co.

1 River Road, Schenectady 5, N. Y.

Electric Motors, Controls, Locomotives, Coordinated Electric Drives for: Shovels, Drag Lines, Conveyors, Hoists, Cranes, Crushers, Screens, Etc.; Coordinated Power Generating and Distributing Systems Including Turbine Generators, Switchgear, Transformers, Cable, Cable Skids, Load Center Substations

### Gill Rock Drill Co.

Lebanon, Pa.

Well Drill Tools and Supplies

### Goodrich, B. F., Co.

500 South Main St., Akron 18, Ohio

Industrial Rubber Products—Flexible Bonded Edge Conveyor and Elevator Belting, Cord Conveyor Belting, Highflex and Cord Transmission Belting; Grommet V-Belts; Type 54 Air Hydraulic Control, Burst Proof Steam, Water, Suction and Other Hose; Armorite Chute Lining; Rubber and Koroseal Protective Clothing and Footwear; Tires and Tubes (Automobile, Truck, Off-the-Road, Industrial), Batteries

### Goodyear Tire & Rubber Co., Inc.

Akron 16, Ohio

Airfoam; Mechanical Goods—Belting (Conveyor, Elevator, Transmission), Hose (Air Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber); Rims (Truck and Tractor); Storage Batteries (Automobile, Truck, Tractor); Tires (Automobile, Truck, Off-the-Road); Tubes (Automobile, Truck, Off-the-Road, LifeGuard, Safety Tubes, Puncture Seal Tubes)

### Gruendler Crusher and Pulverizer Co.

2915 N. Market St., St. Louis 6, Mo.

Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammermills, Lime Pulverizers

### Gulf Oil Corp.

#### Gulf Refining Co.

Gulf Bldg., Pittsburgh 19, Pa.

Lubricating Oils, Greases, Gasoline and Diesel Fuels

### Haiss, George, Mfg. Co., Inc., Division

#### Pettibone Mulliken Corp.

141st-144th on Park Ave., New York 51, N. Y.

Bucket Loaders, Buckets, Portable and Stationary Conveyors, Car Unloaders

## Manufacturers Division—National Crushed Stone Association (continued)

### Harnischfeger Corp.

4400 W. National Ave., Milwaukee 14, Wis.  
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators, Diesel Engines

### HarriSteel Products Co.

420 Lexington Ave., New York 17, N. Y.  
Woven Wire Screen Cloth

### Hayward Co.

50 Church Street, New York 7, N. Y.  
Orange Peel Buckets, Clam Shell Buckets, Electric Motor Buckets, Automatic Take-up Reels

### Heidenreich, E. Lee, Jr., Consulting Engineers

75 Second St., Newburgh, N. Y.  
Plant Layout, Design, Supervision; Open Pit Quarry Surveys; Appraisals—Plant and Property

### Hendrick Mfg. Co.

Carbondale, Pa.  
Perforated Metal Screens, Perforated Plates for Vibrating, Shaking, and Revolving Screens; Elevator Buckets; Test Screens; Wedge Slot Screens; Open Steel Floor Grating

### Hercules Powder Co.

Wilmington 99, Del.  
Explosives and Blasting Supplies

### Hetherington & Berner Inc.

701-745 Kentucky Ave., Indianapolis 7, Ind.  
Asphalt Paving Machinery, Sand and Stone Dryers, Dust Collectors

### Hewitt-Robins Incorporated

370 Lexington Ave., New York 17, N. Y.  
Belt Conveyors (Belting and Machinery); Belt and Bucket Elevators; Car Shake-outs; Feeders; Industrial Hose; Screen Cloth; Sectional Conveyors; Skip Hoists; Stackers; Transmission Belting; Vibrating Conveyors, Feeders, and Screens; Design and Construction of Complete Plants

### Illinois Powder Mfg. Co.

506 Olive St., St. Louis 1, Mo.  
Gold Medal Explosives

### Ingersoll-Rand Co.

11 Broadway, New York 4, N. Y.  
Rock Drills, Quarrymaster Drills, Jackbits, Bit Reconditioning Equipment, Portable and Stationary Air Compressors, Air Hoists, Slusher Hoists, Air Tools, Diesel Engines, Pumps

### Inslay Manufacturing Corp.

801 N. Olney St., Indianapolis 6, Ind.  
Concrete Carts and Buckets, ½ Yd. Cranes and Shovels

### International Harvester Co.

180 N. Michigan Ave., Chicago 1, Ill.  
Motor Trucks, Diesel and Gasoline Power Units; Crawler Tractors; Industrial Wheel Tractors

### Iowa Manufacturing Co.

916 16th St., N.E., Cedar Rapids, Iowa  
Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Hot and Cold Mix Asphalt Plants, Stabilizer Plants, KUBIT Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment, Hammermills

### Jaeger Machine Co.

550 W. Spring St., Columbus 16, Ohio  
Portable and Stationary Air Compressors, Self-Priming Pumps, Truck Mixers, Concrete Mixers, Road Paving Machinery, Hoists and Towers

### Jaite Co.

Jaite, Ohio  
Multiwall Paper Bags, Sewn and Pasted Style for Packaging Lime, Cement, Plaster, Etc.

### Jeffrey Manufacturing Co.

E. First Ave., Columbus 16, Ohio  
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

### Johnson-March Corp.

1724 Chestnut St., Philadelphia 3, Pa.  
Dust Allaying Equipment

### Joy Manufacturing Co.

333 Henry W. Oliver Bldg., Pittsburgh 22, Pa.  
Drills: Blast-Hole, Wagon, Rock, and Core; Air Compressors: Portable, Stationary, and Semi-Portable; Aftercoolers; Portable Blowers; Carpullers; Hoists; Multi-Purpose and Portable Rock Loaders; Air Motors; Trench Diggers; Belt Conveyors; Drill-Bit Furnaces; "Spaders"; "String-a-Lite" (Safety-Lighting-Cable); Backfill Tampers; Drill Bits: Rock and Core

### Kennedy-Van Saun Mfg. & Eng. Corp.

2 Park Ave., New York 16, N. Y.  
Crushing, Screening, Washing, Conveying, Elevating, Grinding, Complete Cement Plants, Complete Lime Plants, Complete Lightweight Aggregate Plants, Synchronous Motors, Air Activated Containers for Transportation of Pulverized Material, Cement Pumps, and Power Plant Equipment

### Kensington Steel Co.

505 Kensington Ave., Chicago 28, Ill.  
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

### King Powder Co., Inc.

Cincinnati, Ohio  
Detonite, Dynamites, and Blasting Supplies

### Koehring Co.

3026 W. Concordia Ave., Milwaukee 16, Wis.  
Excavating, Hauling and Concrete Equipment

### Kraft Bag Corp.

630 Fifth Ave., New York 20, N. Y.  
Heavy Duty Multiwall Paper Bags

## Manufacturers Division—National Crushed Stone Association

(continued)

### Le Roi Co.

#### Cleveland Rock Drill Division

12500 Berea Rd., Cleveland 11, Ohio  
Air Compressors—Portable 60 Cfm. to 600 Cfm. Gas or Diesel; Tractairs—Combined Tractor with 105 Cfm. Air Compressor; Engines; Generator Sets; Rock and Wagon Drills; Jumbo Drill Rigs, Drifters, Stop-ers, Self Propelled Drill Rigs

### Link-Belt Co.

300 West Pershing Road, Chicago 9, Ill.  
Complete Stone Preparation Plants; Conveyors, Elevators, Screens, Washing Equipment, Speed-O-Matic Shovels—Cranes—Draglines and Power Transmission Equipment

### Ludlow-Saylor Wire Co.

634 S. Newstead Ave., St. Louis 10, Mo.  
Woven Wire Screens and Wire Cloth of Super-Loy, All Commercial Alloys and Metals

### Mack Manufacturing Corp.

350 Fifth Ave., New York 1, N. Y.  
On- and Off-Highway Trucks, Tractor Trailers, Six-Wheelers, from 5 to 30 Tons Capacity, both Gasoline- and Diesel-Powered

### Marion Power Shovel Co.

617 W. Center St., Marion, Ohio  
A Complete Line of Power Shovels, Draglines, and Cranes

### Marsh. E. F., Engineering Co.

4324 W. Clayton Ave., St. Louis 10, Mo.  
Plant Design, Engineering Service, Complete Pit and Quarry Equipment

### McLanahan & Stone Corp.

200 Wall St., Hollidaysburg, Pa.  
Complete Pit, Mine, and Quarry Equipment—Crushers, Washers, Screens, Feeders, etc.

### Michigan Power Shovel Co.

270 Miller St., Benton Harbor, Mich.  
Truck Mounted and Crawler Shovel Crane 3/8 and 1/2 Cu. Yd.

### Murphy Diesel Co.

5317 W. Burnham St., Milwaukee 14, Wis.  
Murphy Diesel Engines Ranging from 90 to 190 Continuous Horsepower at 1200 Rpm. and Packaged Type Generator Sets 60 to 133 Kw. for All Classes of Service

### National Amalga-Pave, Inc.

357 S. Robertson Blvd., Beverly Hills, Calif.  
Amalga-Pave Cold Mix Asphalt Paving Process

### New York Rubber Corp.

100 Park Ave., New York 17, N. Y.  
Conveyor Belting: Stonore, Dependable, and Cameo Grades; Transmission Belting: Silver Duck Duroflex, Soft Duck Rugged, Commercial Grade Tractor

### Nordberg Mfg. Co.

3073 S. Chase Ave., Milwaukee 7, Wis.  
Cone, Gyratory, Jaw and Impact Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens; Grizzlies; Diesel and Steam Engines; Compressors; Mine Hoists; Track Maintenance Tools

### Northern Blower Co.

6409 Barberton Ave., Cleveland 2, Ohio  
Dust Collecting Systems, Fans—Exhaust and Blower

### Northwest Engineering Co.

135 S. LaSalle St., Chicago 3, Ill.  
Shovels, Cranes, Draglines, Pullshovels

### Olin Industries, Inc.

#### Explosives Division

East Alton, Ill.  
Dynamite, Black Powder, Blasting Caps, Blasting Supplies

### Osgood Co.

Cheney Ave., Marion, Ohio  
Power Shovels, Cranes, Draglines, Hoes, Etc., 3/8 to 2 1/2 Cu. Yd.

### Pennsylvania Crusher Co.

Liberty Trust Bldg., Broad and Arch Sts., Philadelphia 7, Pa.  
Single Roll Crushers, Impactors, Hammermills, Ring Type Granulators, KUE-KEN Jaw Crushers, KUE-KEN Gyracones, Dixie Non-Clog and Standard Hammermills

### Pettibone Mulliken Corp.

4710 W. Division St., Chicago 51, Ill.  
Buckets, Dragline and Parts; Loaders—Car, Bucket; Plants—Asphalt, Portable

### Pioneer Engineering Works, Inc.

1515 Central Ave., N. E., Minneapolis 13, Minn.  
Jaw Crushers, Roll Crushers (Twin and Triple), Vibrating and Revolving Screens, Feeders (Mechanical, Grizzly, Apron, and Pioneer-Oro), Belt Conveyors, Portable and Stationary Crushing and Screening Plants, Washing Plants, Mining Equipment, Cement and Lime Equipment, Asphalt Plants

### Pit and Quarry Publications

431 S. Dearborn St., Chicago 5, Ill.  
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Concrete Manufacturer, Concrete Industries Yearbook

### Quaker Rubber Corp.

Tacony and Milnor Sts., Philadelphia 24, Pa.  
Conveyor Belts, Hose, and Packings

### Rock Bit Sales and Service Co.

350 Depot St., Asheville, N. C.  
Tungsten Carbide Detachable Bits, "Rock Bit" Drill Steel Inlaid with Tungsten Carbide, Carbon Hollow Drill Steel, Alloy Hollow Drill Steel

## Manufacturers Division—National Crushed Stone Association (concluded)

### Rock Products

309 West Jackson Blvd., Chicago 6, Ill.

### Roebbling's, John A., Sons Co.

Trenton 2, N. J.

Wire Rope, Fittings and Strand, Slings, Suspension Bridges and Cables, Aerial Wire Rope Systems, Ski Lifts, Electric Wire and Cable, Magnet Wire

### Sanderson-Cyclone Drill Co.

South Main St., Orrville, Ohio

All Steel Wire Line, Air Speed Spudders, Large Blast Hole Drills, Drilling Tools and Drilling Supplies

### Schild Bantam Co.

Waverly, Iowa

Bantam Trench Hoes, Draglines, Clams, Shovels

### Screen Equipment Co.

1754 Walden Ave., Buffalo 25, N. Y.

SECO Vibrating Screens

### Simplicity Engineering Co.

Durand, Mich.

Simplicity Gyration Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

### SKF Industries, Inc.

Front St. and Erie Ave., P. O. Box 6731,

Philadelphia 32, Pa.

Anti-Friction Bearings—Self-Aligning Ball, Single Row Deep Groove Ball, Angular Contact Ball, Double Row Deep Groove Ball, Spherical Roller, Cylindrical Roller, Ball Thrust, Spherical Roller Thrust; Pillow Block and Flanged Housings—Ball and Roller

### Smith Engineering Works

532 E. Capitol Drive, Milwaukee 12, Wis.

Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

### Stedman Foundry & Machine Co., Inc.

Aurora, Ind.

Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Lime-stone Pulverizers

### Stephens-Adamson Mfg. Co.

Aurora, Ill.

Belt Conveyors, Elevators, Feeders, Car Pullers, Screens, Skip Hoists, Complete Plants

### Talcott, W. O. & M. W., Inc.

91 Sabin St., Providence 1, R. I.

Belt Fasteners, Belt Lacing, Conveyor Belt Fasteners, and Patch Fasteners

### Taylor-Wharton Iron & Steel Co.

High Bridge, N. J.

Manganese and other Special Alloy Steel Castings; Dipper Teeth, Fronts and Lips; Crawler Treads; Jaw and Cheek Plates; Mantles and Concaves; Pulverizer Hammers and Liners; Asphalt Mixer Liners and Tips; Manganese Nickel Steel Welding Rod and Plate

### Thew Shovel Co.

East 28th St. and Fulton Rd., Lorain, Ohio

Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes, Draglines, Diesel Electric, Gasoline, 3/8 to 2 1/2 Cu. Yd. Capacities

### Torrington Co.

#### Bantam Bearings Division

3702 W. Sample St., South Bend 21, Ind.

Anti-Friction Bearings; Roller Bearings; Spherical, Tapered, Straight, Ball, Needle

### Traylor Engineering & Mfg. Co.

Allentown, Pa.

Stone Crushing, Gravel, Lime, and Cement Machinery

### Trojan Powder Co.

17 N. 7th St., Allentown, Pa.

Explosives and Blasting Supplies

### Tyler, W. S., Co.

3615 Superior Ave., N. E., Cleveland 14, Ohio

Woven Wire Screens; Ty-Rock, Tyler-Niagara and Ty-Rocket (Mechanically Vibrated) Screens; Hum-mer Electric Screens; Ro-Tap Testing Sieve Shakers and Tyler Standard Screen Scale Sieves

### Universal Engineering Corp.

625 C Ave., N. W., Cedar Rapids, Iowa.

Jaw Crushers, Roll Crushers, Hammermills, Complete Crushing, Screening, and Loading Plants, Either Stationary or Portable for Stone Aggregates or Aglime

### Vibration Measurement Engineers

7665 Sheridan Rd., Chicago 26, Ill.

Specialists in Blasting Complaint Investigations; Seismological Surveying; Expert Testimony in Blasting Litigation

### Werco Steel Co.

2151 E. 83rd St., Chicago 17, Ill.

Crusher Jaws, Roll Shells, Mantles, Bowl Liners, Conveyor and Elevator Chain, All Types Wear Resistant Steel Manganese and Alloy Steel Castings

### Weston Dump Body Co.

326 S. W. 11th St., Des Moines, Iowa

Combination Lime, Sand, and Gravel Body; Special Bodies for Quarry and Pit Work

### White Motor Co.

842 E. 79th St., Cleveland 1, Ohio

On- and Off-Highway Trucks and Tractors—Gasoline- and Diesel-Powered; Industrial Engines, Power Units, Axles, Special Machine Assemblies; All Classes of Service